where there are the most delicate root-tips. This increased spread of root makes it mechanically possible, too, for the plant to carry its light exposure to positions of greater advantage. Many of such plants, the trees and shrubs, have found the habits of the marsh and water plants, that give up most of their structures at the close of the growing season, most extravagant. The former have learned how to protect the essential part of those structures through which the plants make their different exposures. This means an immense advantage to the plant in added possibilities of growth.

As the drier portions of the earth are encountered, the light remaining essentially the same, the plants turn their attention more and more to the solution of the water question. The trees in the great forest areas of the globe can do with nothing less than oceans of rainfall; but many members of the grass tribe, by a most ingenious leaf device and a prolific root development, can thrive where dews almost take the place of rain. In still drier regions the thin spreading leaf structures are abandoned, and the responsibility of maintaining both the light and water relation is assumed by the stem, as in the cactus, where the whole plant becomes a kind of reservoir. Thus it has been, by infinite pliability and patience, that the plants have persisted through millions of years, developing, growing, and spreading until there is scarcely a square foot on the globe that has not been occupied by them.

Spring Studies

Ira B. Meyers

Tree Growth: Relation to Form Structure and Wood Properties

From the first awakening of life in germination through all its life stages to old age and decay, the tree is subject to the varying influences of heat, light, moisture, soil, winds, animal life, and other plants. The total of these external influences is called the tree's environment. The living tree must adjust itself to the constant and varying influences of its environment. To assist it in its adjustment it has certain structures or organs which develop in form and arrangements according to their function and the nature of the tree environment.

Our study of the tree should help us to understand something of the function of its various structures, and how these functions are performed.

It should tell us why one tree is tall and another spreading; why one has an oval and another a conical top; why one tree leaves before it flowers and another flowers before it leaves. Our observations should help us to discover why so many seeds germinate and so few mature; they should enable us to find out from these silent objects their reasons for living and growing as they do.

To do this, we must find out the needs of the tree, and how it supplies these needs in sufficient quantities for living.

I. General Observations.

1. Outline form of unfoliaged trees. (a) Top. (b) Trunk.

2. Variation of form in trees of the same variety. (a) Isolated. (b) Woodland.

3. Variation of form in trees of different species.

4. Try to determine conditions and adaptations which influence tree form.

5. Make drawings showing characteristic forms.

6. What growths determine form?

7. Consider: (a) Form of trunk. (b) Length of branches. (c) Spread of branches. (d) Angle of branches.

8. What is the nature of a growth producing straight branches? Zigzag branches?

II. Twigs and Bark.

1. Note ring-like markings at intervals on twigs. These rings mark the yearly growth of the twig.

2. Compare the lengths of these growths. (a) On different branches of the same tree. (b) On different trees of the same kind. (c) On different trees of different species.

3. Can you tell by the appearance of a tree's top whether annual growth is slow or rapid?

4. How many annual growths can you distinguish on the same twig? (a) Do these growths vary in length? (b) What conditions would cause variation?

5. Do you identify any of the trees by their bark?

6. Make drawings of characteristic barks.

7. What seems to be the function of bark?

8. How do you account for its varied character?

9. Examine twigs for small dots (lenticels). Do these lenticels affect the nature of splitting or peeling of old bark?

III. Trunk Growth.

1. How does a tree increase its circumference? Its height?

2. What part of the trunk is of last year's growth?

3. In what parts of the tree will growth take place this season?

4. What relation as to position will this year's growth bear to that of last year?

5. What markings result from these yearly growths?

6. What relation as to number would the rings at the butt of a tree bear to those ten feet up?

7. How do you account for the height from the ground of the first branches on trees? (These are frequently forty feet up.)

8. Is the heart-wood (duramen) necessary to growth? Proof?

9. The sap-wood (alburnum)? Proof.

IV. Lumber.

1. Try to identify the woods used in house-finishing, furniture, carriage construction, etc.

2. What determines the choice of woods for these various purposes?

3. Make comparative strength tests of various woods. (See Jackman, *Nature Study for Grammar Grades*, p. 275.)

4. Note the various natural grains of woods.

5. Can you determine the trunk markings that determine this grain?

6. Examine cross and longitudinal sections of trees.

7. Show by drawing the position that the various grained woods must have occupied in the log.

8. Can a sawyer tell the style of grain possible before sawing the log?

V. Materials Available for Wood Study.

1. Trees of parks.

2. Cross and longitudinal sections of trees.

3. Hough's *American Woods* (library).

4. Stereopticon slides of wood sections; also microscopic slides for study of structure.

5. Stereopticon slides on lumber industry and forest trees.

References: U. S. Dept. Agriculture, Bulletin No. 10, Division of Forestry, *Timber;* Bulletin No. 24, *A Primer of Forestry.*

Notes on Birds

The few birds of winter and early spring are no less interesting than the greater numbers of summer. The presence of these birds indicates that their food is available during the winter months. It may be generally stated that the presence or absence of birds, their places of living, their structures and habits, are influenced more by their food than by any other factor. If you would understand the meaning of bird ways, find out their places and habits of feeding.

The limited food supply and their small number give an excellent opportunity to know our winter and early spring birds.

In observing birds, try to acquire the habit of noting their shape and size, prevailing color, color marks on head, wing, throat, and tail; where the bird was seen—tree trunk, branches, on ground, meadow, woods, swamp, or shore; what it was doing when seen; characteristic movements; its song or call.

The following birds are found in the vicinity of Chicago during early March:

English sparrow; snow-bird (slate-colored junco), found in meadows, wastes, vacant lots and seed patches; tree-sparrow, frequently seen with the juncos; thistle-bird (wild-canary, gold finch), prairie wastes, seed thickets; horned lark, prairie, or frequently found walking in roadways; black-capped chickadee, wooded thickets, parks, etc.; blue jay; white-bellied nuthatch, on tree trunks, frequently with head downward, a conspicuous acrobat; downy woodpecker, on trunk and limbs of trees, frequently inspecting cocoons; gulls, lake front, our great water scavengers; butcher-bird (northern shrike); crow; yellow-bellied woodpecker; brown-creeper, running up trunks of trees, seldom going higher than the first branches, etc.

In addition to the interest we may have in the life habits of birds, is their influence on plant and other animal life through their food relations. The snow-bird and tree-sparrow feed entirely upon seeds of weeds during winter. Professor Beal has estimated that each of these birds consumes about one-quarter of an ounce of seeds daily, and that in a single state (Iowa) they destroy 1,750,000 pounds or 875 tons of weed seeds annually.

The spring arrival of new birds generally indicates that a new food is available. The geese and ducks begin to fly as soon as the ice breaks on ponds and streams. They have access to the food on the bottom. The robin appears as soon as the ground thaws sufficiently for the earthworm to come to the surface.

I. Observation.

1. Make a list of the birds you see during the first week of March.

2. Add to the list the later arrivals with date.

3. Try to find out the nature of the food taken by these various birds. The time of year during which the food is available.

4. Was the food available in any quantity before you saw the bird?

5. Do birds have any special modification of bill, feet, wings, or tail to assist them in securing their food?

6. Make drawings of the bills and feet of birds showing various modifications and the special function of each.

7. What birds do you recognize by their flight? By their call or song?

8. During the month watch for wild geese and ducks. Can you tell them apart by their flight-formations? By their calls?

II. Special Field Study.

1. Sketch typical meadow, woodland, water areas, etc., and note the birds living and feeding in these areas.

2. To what extent do their habits and structures give them special advantage in the area they inhabit? (a) Discovering and prehending their food. (b) Escaping enemies. (c) Nesting and rearing young.

III. Birds likely to arrive during March: golden-crowned kinglet, purple martin, rusty blackbird, killdeer, song sparrow, fox sparrow, red-winged blackbird, bluebird, bronzed grackle, cowbird, flicker, phœbe, ruby-crowned kinglet, hermit thrush, meadow lark.

References: Year Book, Department of Agriculture, 1898, *Birds as Weed-Destroyers;* Farmers' Bulletin, No. 54, *Some Common Birds;* Thompson, *Wild Animals: Calls and Feeding of Crows, Silverspot* (p. 59), *Winter Ways, Redruff* (pp. 330 and 346); Chapman, *Hand-book for Study of Birds, Bird Life;* Wright, *Birdcraft.*